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(54) Structure of rotor for outer rotor type brushless motor

Rotoranordnung für einen bürstenlosen Motor der Aussenläuferbauart

Structure d'un rotor pour moteur sans balais à rotor extérieur

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(73) Proprietor: **LG ELECTRONICS INC.**
Seoul (KR)

(72) Inventors:
- **Shin, Hyoun Jeong**
Namdong-Ku,
Inchon (KR)
- **Park, Jin Soo**
Namdong-Ku,
Inchon (KR)
- **Rew, Ho Seon**
Seoul (KR)
- **Hong, Sang Wook**
Seoul (KR)

(74) Representative: **Cohausz & Florack**
Patent- und Rechtsanwälte
Bleichstrasse 14
40211 Düsseldorf (DE)

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- **PATENT ABSTRACTS OF JAPAN vol. 1998, no. 13, 30 November 1998 (1998-11-30) -& JP 10 210727 A (NIPPON ELECTRIC IND CO LTD), 7 August 1998 (1998-08-07)**
- **PATENT ABSTRACTS OF JAPAN vol. 011, no. 081 (E-488), 12 March 1987 (1987-03-12) -& JP 61 236350 A (HITACHI LTD), 21 October 1986 (1986-10-21)**
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Description

[0001] The present invention relates to a structure of rotor for an outer rotor type brushless motor, comprising a steel plate frame including a disc shaped base plate unit having a plurality of ventilation holes, a back yoke unit extended for a predetermined length in the axial direction, from the outer circumferential portion of the disc shaped base plate unit, and a radial direction stiffness enhancing unit formed at an end portion of the back yoke unit, one or a plurality of ring type permanent magnets being fixedly connected to the inner side portion of the back yoke unit, and a fixing unit fixing a driving shaft inserted into a connecting member and connected to other constitutional elements.

[0002] As illustrated in Figure 1, a general outer rotor type brushless motor (BLDC) includes: a stator 100 where a coil is wound round a magnetic core 10; a resin frame 220 in a predetermined shape fabricated with a resin by using a die; a rotor 200 positioned outside the stator 100 in order to be alternately rotated in the right and left directions; and a sensor unit 300 connected to the stator 100, detecting a position of a permanent magnet 210 of the rotated rotor 200, and sequentially transmitting a current to the stator 100.

[0003] A driving shaft 400 is inserted into a center portion of the rotor 200.

[0004] The structure of the rotor 200 will now be described in more detail.

[0005] As depicted in Figures 2a and 2b, in the conventional outer rotor type brushless motor, the resin frame 220 forming an outer shape of the rotor 200 is formed having a predetermined height, a permanent magnet supporting unit 222 connected with the permanent magnet 210 being axially bent and extended in an axial, that is upward, direction, and bent toward the center portion, at the outer circumferential portion of a disc-shaped base unit 221.

[0006] A ring-shaped deposition groove 223 having a predetermined length and width is formed at the inner wall of the permanent magnet supporting unit 222. A ring-shaped back yoke 230 having a predetermined width is inserted into the deposition groove 223. The plurality of permanent magnets 210 are stacked and adhered to the inner side portion of the back yoke 230 at predetermined intervals in a circumference direction.

[0007] The back yoke 230 is fabricated by rolling a thin steel plate, and serves to form a magnetic circuit of the permanent magnet 210. The back yoke 230 and the permanent magnet 210 are formed in a single body by a thermoplastic resin.

[0008] On the other hand, a boss unit 224 having a predetermined length is formed at the center portion of the base unit 221. A through hole 224a is formed at the center portion of the boss unit 224. A serrated unit 225 having a plurality of triangle-shaped teeth is formed at the inner circumferential surface of the through hole 224a.

[0009] A serrated shaft unit 401 formed at the outer circumferential surface of the driving shaft 400 is inserted into the serrated unit 225 of the resin frame 220, and thus the resin frame 220 and the driving shaft 400 are combined. A spacer 410 is inserted into the lower portion of the serrated shaft unit 401 inserted into the serrated unit 225 of the resin frame 220. A nut 420 is fastened to a lower portion of the spacer 410, namely an end portion of the driving shaft 400.

[0010] On the other hand, a ventilation fan blade 226 and a ventilation hole 227 are provided on the bottom surface of the base unit 221 in order to cool a heat which is always generated during the rotation of the rotor 200 by means of an external air inflow.

[0011] As shown in Figure 2b, a plurality of ventilation blades 226 are formed in the base unit 221 in a radial shape centering around the boss unit 224. The plurality of ventilation blades 226 have a predetermined thickness and width, and are formed in a axial direction from the boss unit 224 to the permanent magnetic supporting unit 222.

[0012] In addition, a plurality of ventilation holes 227 are formed in the base unit 221 at predetermined intervals in a circumferential direction. The plurality of ventilation holes 227 are positioned to form a concentric circle, and cross the ventilation blades 226.

[0013] In the above-described rotor 200, the permanent magnets 210 are positioned having a predetermined space from the stator 100. The driving shaft 400 connected to the resin frame 220 is fixedly connected to other constitutional elements.

[0014] In the conventional outer rotor type brushless motor, when a current sequentially flows to the coil 20 wound round the stator 100, the rotor 200 is rotated according to interaction between the current flowing in the coil 20 and the permanent magnet 210. The rotation force of the rotor 200 is transmitted to other constitutional elements through the driving shaft 400.

[0015] For example, in case the outer rotor type brushless motor adapts to a washing machine, the stator 100 is deposited in an outer casing including an inner casing, the driving shaft 400 is connected to the inner casing of the washing machine, and thus the driving force of the rotor can be transmitted to the devices such as the washing machine through the driving shaft 400.

[0016] During the rotation of the rotor 200, the air flows into the motor by the ventilation fan blades 226 and the ventilation holes 227, thereby cooling the heat generated in the motor.

[0017] However, while rotated by the interaction force with the current applied to the winding coil of the stator, as depicted in Figures 3a and 3b, the rotor for the conventional outer rotor type brushless motor is vibrated in a shaft direction and a radial direction.

[0018] The vibration is generated because the resin frame connected with the permanent magnet consists of the resin, and thus stiffness of the material is weak (approximately 15% of the steel plate). Especially, the vibra-

tion of the resin frame resulting from the vibration in the radial direction increases noise.

[0019] Moreover, since the frame consists of the resin, the serrated unit of the frame connected to the driving shaft transmitting the driving force generated from the rotor is easily abraded under the operational conditions of high temperature, high torque and impact load, and thus a life span thereof is reduced, thereby decreasing the durability of the rotor and thus of the motor.

[0020] In addition, the ventilation fan blades for cooling the inside of the motor with the external air are formed in a axial direction. Therefore, when the rotor is rotated in one direction, an amount of the air which flows into the motor and is discharged therefrom is increased. As the thermal conductivity of the resin is low, ventilation is not efficient, thereby further decreasing the durability of the motor.

[0021] Furthermore, the frame consisting of the resin is very weak to a fatigue destruction resulting from a repeated stress generated by alternation of the washing machine. Accordingly, the ventilation holes must be formed small. However, the small ventilation holes cannot sufficiently perform a cooling operation. As a result, when the cooling operation is ill-performed, a resistance of the coil is increased, motor efficiency is reduced, a temperature of the coil is more increased, and thus the coil may be easily damaged. Consequently, an expensive coil of high quality must be used.

[0022] The resin frame consists of the resin, and thus a price thereof is relatively high. Also, it is necessary to separately fabricate and connect the back yoke in order to form the magnetic circuit, which results in increased production and assembly costs.

[0023] A structure of rotor for an outer rotor type brushless motor as described above is for example disclosed in US 5,659,216, the structure of rotor comprising a steel plate frame including a disc shaped base plate unit having a plurality of ventilation holes being formed radially; a back yoke unit extended in the axial direction, having a predetermined length outwardly of the base plate unit; and a radial direction stiffness enhancing unit formed at the axial end portion of the back yoke unit; one or a plurality of ring type permanent magnets being fixedly connected to the inner side portion of the back yoke unit; and a fixing unit fixing a driving shaft inserted into the connecting member and connected to the other constitution elements.

[0024] The problem of the structure disclosed in US 5,659,216 is that the durability of the motor is relatively low.

[0025] Further rotor structures are known from US 5,907,206, DE 33 29 720 A1, JP 10210727 A and JP 61236350 A. But also these known structures are not suitable to improve the durability of a corresponding brushless motor in a sufficient way.

[0026] It is an object of the present invention to provide a cost-efficient structure of a rotor for a brushless motor (BLDC) which can improve the durability of the motor.

[0027] In order to achieve the above-described object of the present invention, there is provided A structure of rotor for an outer rotor type brushless motor, comprising a steel plate frame including a disc shaped base plate unit having a plurality of ventilation holes, a back yoke unit extended for a predetermined length in the axial direction, from the outer circumferential portion of the disc shaped base plate unit, and a radial direction stiffness enhancing unit formed at an end portion of the back yoke unit, one or a plurality of ring type permanent magnets being fixedly connected to the inner side portion of the back yoke unit, and a fixing unit fixing a driving shaft inserted into a connecting member and connected to other constitutional elements, wherein the base plate unit has a plurality of insertion holes at its center portion, the plurality of ventilation holes being formed at the circumferential portion of the insertion holes, and a plurality of blades being formed at side portions of the ventilation holes by cutting, wherein the connecting member, connected to the steal plate frame, is engaged with the driving shaft which is inserted into the shaft insertion hole of the plurality insertion holes positioned at the center of the base plate unit, and wherein the radial direction stiffness enhancing unit is extended in the radial inward or outward direction at the end portion of the back yoke unit, and a support frame formed in an annular shape is provided at the outer portion of the base plate unit, at least partially surrounding the bottom and side portions of the back yoke unit.

[0028] Further embodiments can be derived from the dependent claims.

[0029] The present invention will become better understood with reference to the accompanying drawings which are given only by way of illustration and thus are not limitative of the present invention, wherein:

Figure 1 is a front cross-sectional view illustrating a conventional outer rotor type brushless motor (BLDC);

Figure 2a is a front cross-sectional view illustrating a structure of a rotor for the conventional outer rotor type brushless motor;

Figure 2b is a plan view illustrating the structure of the rotor for the conventional outer rotor type brushless motor;

Figure 3a is a front cross-sectional view illustrating a state where the rotor is vibrated in a radial direction during the driving of the conventional outer rotor type brushless motor;

Figure 3b is a front cross-sectional view illustrating a state where the rotor is vibrated in a shaft direction during the driving of the conventional outer rotor type brushless motor;

Figure 4a is a front cross-sectional view illustrating the structure of the rotor of another conventional outer rotor type brushless motor;

Figure 4b is a plan view illustrating the structure of the rotor of the conventional outer rotor type brush-

less motor;

Figure 4c is a bottom view illustrating a structure of a rotor of another conventional outer rotor type brushless motor;

Figure 5a is a cross-sectional view illustrating a stiffness enhancing rib formed on the rotor of a conventional outer rotor type brushless motor;

Figure 5b is a cross-sectional view illustrating another conventional embodiment of Figure 5a;

Figure 6 is a bottom view illustrating another conventional embodiment of Figure 4C;

Figure 7a is a cross-sectional view illustrating ventilation holes and blades formed on the rotor of an conventional outer rotor type brushless motor;

Figure 7b is a cross-sectional view illustrating another conventional embodiment of Figure 7a;

Figure 8 is a front cross-sectional view schematically illustrating a first example of a support frame connected to an outer circumferential portion of a back yoke unit of the rotor of the outer rotor type brushless motor in accordance with the present invention;

Figure 9 is a front cross-sectional view schematically illustrating a second example of the support frame in Figure 8;

Figure 10 is a front cross-sectional view schematically illustrating an example of a conventional support frame; and

Figure 11 is a front cross-sectional view schematically illustrating another example of a conventional support frame;

A structure of a rotor for an outer rotor type brushless motor (BLDC) in accordance with preferred embodiments of the present invention will now be described with reference to the accompanying drawings.

[0030] Here, the identical constitutional elements to the conventional art are provided with the same reference numerals.

[0031] As illustrated in Figures 4a to 4c, the rotor of a conventional outer rotor type brushless motor includes a steel plate frame 510 in a cylinder shape having a plurality of insertion holes 511 at its center portion, an upper portion of which being opened. A back yoke unit 513 is bent and extended in the axial direction, having a predetermined length outwardly of a base plate unit 512, a plurality of permanent magnets 520 being fixedly connected to an inner side portion of the back yoke unit 513.

[0032] The base plate unit 512 is formed in a disc shape, a center portion of which being protruded in the axial direction, making an irregular shape with peripheral portions.

[0033] The plurality of insertion holes 511 are formed at the center portion, and include a shaft insertion hole 511 a which a driving shaft 400 is inserted into; and a plurality of fastening member insertion holes 511b which are formed at the outer circumferential portion of the shaft insertion hole 511 a, and which a fastening member 520 is inserted into.

[0034] On the other hand, a connection guide unit 514 is protrusively formed in the axial direction at the outer circumferential portion of the fastening member insertion hole 511b in the base plate unit 512, so that a connecting member 530 fastened to the steel plate frame 510 by the fastening member 520 can be easily connected to the base plate unit 512.

[0035] The connecting member 530 consists of a steel material, and is fixedly connected to the steel plate frame 510.

[0036] As depicted in Figures 4b and 4c, in order to increase a natural frequency of the rotor 500, a plurality of stiffness enhancing ribs 515 which are longitudinally embossed in a radial direction are formed in a radial shape at a predetermined portion of the base plate unit 512.

[0037] The stiffness enhancing ribs 515 serve to prevent generation of resonance with other constitutional elements during the driving of the rotor 500.

[0038] As illustrated in Figures 5a and 5b, the end portion of the stiffness enhancing rib 515 is according to the prior art for example formed in an isosceles triangle shape. The embossing direction is protruded toward the upper or lower portion of the base plate unit 512.

[0039] In addition, a plurality of ventilation holes 516 are formed at the outer circumferential portions of the plurality of insertion holes 511 formed at the center portion of the base plate unit 512. A blade 517 for guiding an air inflow by rotation of the rotor 500 is formed at the side portions of the respective ventilation holes 516.

[0040] The ventilation hole 516 and the blade 517 may be formed by a press process at the same time, or the blade 517 may be adhered after forming the ventilation hole 516. One or more ventilation holes 516 and blades 517 are formed between the stiffness enhancing ribs 515 at predetermined intervals.

[0041] According to another conventional embodiment as shown in Figure 4c, one ventilation hole 516 and one blade 517 are formed between the stiffness enhancing ribs 515. According to another conventional embodiment as shown in Figure 6, two ventilation holes 516 and two blades 517 are formed between the stiffness enhancing ribs 515.

[0042] In general, it is preferable that the ventilation holes 516 are formed in a maximum number so long as the structural stiffness of the base plate unit 512 is maintained, and thus maximizes an amount of air flowing into the motor.

[0043] The shape of the ventilation hole 516 will now be described in detail. The ventilation hole 516 is longitudinally formed in a radial direction at the base plate unit 512. The blade 517 is fixed after an edge of a cutting portion of the ventilation hole 516 is rotated by a predetermined angle.

[0044] In more detail, as illustrated in Figures 7a and 7b, according to the prior art in order to form the ventilation hole 516, a predetermined portion of the base plate unit 512 is cut in the radial direction. The cutting portion

is rotated by a predetermined length (h), centering around a portion corresponding to a length (L) to the circumferential direction of the ventilation hole 516, and fixed, thereby forming the blade 517.

[0045] In the prior art, it is known to form the plurality of blades 517 to be sloped in the same direction, and to form a width of the ventilation hole 516 to be equal to or greater than a height of the blade 517 (h/L<1). In addition, the blade 517 is sloped against the inner or outer side of the stator coil 20. Here, an angle of slope is preferably between 60° and 90° in regard to the surface of the base plate unit 512.

[0046] Figure 7a shows a state where the blade 517 is fixedly sloped against the outer side of the stator coil 20, and Figure 7b shows a state where the blade 517 is fixedly sloped against the inner side thereof. In the former, a large amount of air flows into the motor, but an accident may take place during components assembly. In the latter, an amount of air flowing into the motor is more or less small, but an accident is prevented.

[0047] In order to receive one or more ring-shaped permanent magnets 540 in the circumferential direction at predetermined intervals, a jaw 513a having a predetermined width in a horizontal, that is radial, direction and a contact surface 513b extended in a vertical, that is axial, direction to the jaw 513a are formed at the inner surface of the back yoke unit 513.

[0048] The permanent magnets 540 are positioned on the jaw 513a, contacted with the contact surface 513b, and fixedly connected to the back yoke unit 513 by an adhesive or, by positioning a resin for adhesion 550 at their upper portions.

[0049] In order to enhance stiffness of the steel plate frame 510 in the radial direction, a radial-direction stiffness enhancing unit 518 axially bent and extended in the outward direction is formed at the axial end portion of the back yoke unit 513.

[0050] In accordance with a first embodiment of the present invention, as shown in Figure 8, in order to more enhance stiffness in the radial direction, a radial-direction stiffness enhancing unit 618 is inwardly bent at an upper portion of a region supporting the magnets 540, thereby supporting the magnets 540 by an elastic force of the base plate unit 512. In addition, in order to enhance stiffness of the base plate unit 512 consisting of a steel material in the radial direction, a support frame 660 is provided at the outer portion of the base plate unit 512, and an axial end portion thereof is radially bent and extended in the outward direction.

[0051] That is to say, the support frame 660 is bent several times, thus partially surrounding the outsides of the bottom and side portions of the back yoke unit 613. The axial end portion thereof is outwardly bent and extended.

[0052] On the other hand, in accordance with a second embodiment of the present invention, as illustrated in Figure 9, a radial-direction enhancing unit 718 is axially bent and extended in the outward direction at the axial end portion of a back yoke unit 713, and a support frame 760 is bent, thereby surrounding the whole outsides of the bottom and side portions of the back yoke unit 713.

[0053] In accordance with another conventional embodiment, as shown in Figure 10, a radial-direction enhancing unit 818 is extendedly formed in a reverse U shape in the outward direction at the axial end portion of the back yoke unit 813.

[0054] According to yet another conventional embodiment, as depicted in Figure 11, a radial-direction enhancing unit 918 is axially bent and extended in the outward direction at the axial end portion of the back yoke unit 913, and a support frame 960 is formed in a disc shape with its center portion empty, as if covering the upper circumferential portion of the steel plate frame 512, facing an inner portion thereof.

[0055] As described above, the support frame in accordance with the respective embodiments of the present invention is protrusively formed in the inward or outward direction of the base plate unit 512, thereby sufficiently enhancing the stiffness in the radial direction.

[0056] On the other hand, the connecting member 530 includes: a ring-shaped flange unit 531 having a predetermined thickness and area; a boss unit 532 axially extended at the center portion of the flange unit 531, and having a predetermined outside diameter and length; a serrated hole 533 formed at an inner circumferential portion of a through hole 532a formed at the boss unit 532 in upper and lower directions, and engaged with the serrated shaft unit 401 formed at the driving shaft 400; and a plurality of connecting member combining units 534 formed at the flange unit 531, and fastened to the fastening member 520.

[0057] The plurality of connecting member combining units 534 formed at the flange unit 531 are screw holes making a concentric circle shape.

[0058] A guide hole 535 which the connection guide unit 514 formed at the upper portion of the base plate unit 512 is inserted into is formed having a predetermined depth at the lower portion of the connecting member combining unit 534.

[0059] On the other hand, although not illustrated in the drawings, a specific guide pin may be formed in the connection guide unit 514.

[0060] The fastening unit 520 includes a plurality of bolts. The bolts are passed through the fastening unit insertion holes 511b, and thereafter fastened to the connecting member combining unit 534, thereby connecting the connecting member 530 to the base plate unit 512 of the steel plate frame 510. A specific nut may be fastened to the fastening unit 520.

[0061] The serrated shaft unit 401 is formed at the outer circumferential portion of the driving shaft 400 transmitting the rotation force of the rotor 500 in order to be engaged with the serrated hole 533 of the connecting member 530, and a male screw unit 402 is formed at the lower portion thereof.

[0062] The driving shaft 400 is connected to the ser-

rated hole 533 of the connecting member 530 connected to the steel plate frame 510. At the same time, the spacer 410 is inserted into the end portion of the driving shaft 400, and the nut 420 which is a fixing unit is fastened to the male screw unit 402, thereby fixedly connecting the driving shaft 400 to the steel plate frame 510.

[0063] The assembly process of the rotor for the outer rotor type brushless motor in accordance with the present invention will now be explained.

[0064] Firstly, the shape of the steel plate frame 510 is manufactured by a press. The permanent magnets 540 are positioned at the inner circumferential portion of the back yoke unit 513 of the steel plate frame 510. Thereafter, the permanent magnets 540 are fixedly adhered to the back yoke unit 513 by the adhesive or resin for adhesion 550.

[0065] The screw hole 534 which is the connecting member combining unit accords with the fastening unit insertion hole 511 b of the base plate unit 512 of the steel plate unit 510, and a bolt which is the fastening unit 520 is fastened thereto, thereby connecting the connecting member 530 to the steel plate frame 510.

[0066] The serrated shaft unit 401 of the driving shaft 400 is inserted into the serrated hole 533 of the connecting member 530, the spacer 401 is inserted into the lower portion of the driving shaft 400, and the nut 420 is fastened to the male screw unit 402 of the driving shaft 400, thereby fixedly connecting the driving shaft 400, the steel plate frame 510 and the connecting member 530.

[0067] In accordance with the outer rotor type brushless motor of the present invention, the permanent magnets 540 composing the rotor 500 are positioned to surround the stator 100, and the driving shaft 400 is connected to other constitutional elements.

[0068] According to the outer rotor type brushless motor of the present invention, when a current is applied to the coil 20 composing the stator 100, the rotor 500 is rotated by the interaction force between the current flowing in the coil 20 and the permanent magnets 540, and the driving shaft 400 connected to the rotor 500 transmits the rotation force generated from the rotor 500 to the other constitutional elements.

[0069] In accordance with the present invention, the steel plate frame 510 consists of a steel material, and thus stiffness is relatively high. In addition, at the base plate unit of the steel plate frame 510, the stiffness enhancing rib 515 is formed in order to enhance stiffness in the shaft direction, and the radial-direction enhancing unit 518 is formed in order to enhance stiffness in the radial direction. The support frame is connected to the outer portion of the stiffness enhancing unit 518, thus increasing the structural stiffness and reducing the vibration. As a result, the noise generation is restricted.

[0070] Also, the blades 517 formed at the base plate unit 512 of the steel plate frame 510 are protrusively sloped in one direction, and thus the external air may smoothly flow into the motor during the rotation. Accordingly, the heat generated in the motor can be efficiently cooled.

[0071] Furthermore, the connecting member 530 connected to the driving shaft 400 is firmly fastened to the steel plate frame 510 by the bolt which is the fastening unit 520. Also, the material stiffness is high, and thus resists the high torque, impact load and high temperature. As a result, the components may not be abraded or damaged, and durability thereof is improved.

[0072] Moreover, the steel plate frame 510 and other components consist of a steel material, and thus a fabrication cost thereof is reduced by approximately 5 times, as compared with the resin in the conventional art. In addition, while the back yoke 230 is fabricated by rolling a thin steel plate in the conventional art, it is not specially fabricated, but formed in a single body with the steel plate frame 510 in accordance with the present invention.

[0073] As discussed earlier, the structure of the rotor for the outer rotor type brushless motor in accordance with the present invention increases the structural stiffness, and restricts generation of the vibration and nose during the operation, thereby improving reliability. In addition, the present invention efficiently cools the heat generated in the motor during the operation, thereby improving the efficiency of the motor. Moreover, the back yoke unit is not specially fabricated, but formed in a single body with the steel plate frame, thereby reducing the fabrication cost.

Claims

1. A structure of rotor for an outer rotor type brushless motor, comprising:

    a steel plate frame (510) including a disc shaped base plate unit (512) having a plurality of ventilation holes (516); a back yoke unit (613,713) extended for a predetermined length in the axial direction, from the outer circumferential portion of the disc shaped base plate unit (512); and a radial direction stiffness enhancing unit (618,718) formed at an end portion of the back yoke unit (613,713);
    one or a plurality of ring type permanent magnets (540) being fixedly connected to the inner side portion of the back yoke unit (613,713); and
    a fixing unit fixing a driving shaft (400) inserted into a connecting member (530) and connected to other constitutional elements,

    characterized in that the base plate unit (512) has a plurality of insertion holes (511) at its center portion, the plurality of ventilation holes (516) being formed at the circumferential portion of the insertion holes (511), and a plurality of blades (517) being formed at side portions of the ventilation holes (516) by cutting,
    wherein the connecting member (530), connected

to the steel plate frame (510), is engaged with the driving shaft (400) which is inserted into the shaft insertion hole (511a) of the plurality insertion holes (511) positioned at the center of the base plate unit (512), and
wherein the radial direction stiffness enhancing unit (618,718) is extended in the radial inward or outward direction at the end portion of the back yoke unit (613,713), and a support frame (660, 760) formed in an annular shape is provided at the outer portion of the base plate unit (512), at least partially surrounding the bottom and side portions of the back yoke unit (613,713).

2. The structure according to claim 1, wherein a jaw (513a) having a predetermined width in a radial direction and a contact surface extended in an axial direction relative to the jaw (513a) are formed at the inner surface of the back yoke unit (613,713).

3. The structure according to claim 2, wherein the permanent magnets (540) are positioned on the jaw (513a), contacted with the contact surface, and fixedly connected to the back yoke unit (613,713) by an adhesive or, by positioning a resin for adhesion (550) at their end portions.

4. The structure according to claim 1, wherein the plurality of insertion holes (511) are formed at the center portion, and comprise the shaft insertion hole (511a) into which the driving shaft (400) is inserted and a plurality of fastening member insertion holes (511b) into which a fastening member (520) is inserted.

5. The structure according to claim 4, wherein a connection guide unit (514) is protrusively formed in axial direction at the outer circumferential portion of the fastening member insertion hole (511b).

6. The structure according to claim 4, wherein the connecting member (530) comprises:

a ring-shaped flange unit (531) having a predetermined thickness and area;
a boss unit (532) axially extended at the center portion of the flange unit (531), and having a predetermined outside diameter and length;
a serrated hole (533) formed at an inner circumferential portion of a through hole (532a) formed at the boss unit (532) in axial directions, and engaged with a serrated shaft unit (401) formed at the driving shaft (400); and
a plurality of combining units (534) for combining the connecting member (530) formed at the flange unit (531), and fastened to the fastening member (520).

7. The structure according to claim 6, wherein a guide hole (535) into which the connection guide unit (514) formed at the base plate unit (512) is inserted is formed having a predetermined depth at the combining units (534) for combining the connecting member (530).

8. The structure according to claim 7, wherein a specific guide pin is fastened to the connection guide unit (514).

9. The structure according to claim 6, wherein the plurality of combining units (534) for combining the connecting member (530) are arranged making a concentric circle shape.

10. The structure according to claim 1, wherein a plurality of stiffness enhancing ribs (515) are formed in the radial direction at a predetermined portion of the base plate unit (512), and one or more ventilation holes (516) and blades (517) are formed between the stiffness enhancing ribs (515).

11. The structure according to claim 10, wherein an embossing direction of the stiffness enhancing ribs (515) is protruded toward one end portion of the base plate unit (512).

12. The structure according to claim 10, wherein an embossing direction of the stiffness enhancing ribs (515) is protruded toward the other end portion of the base plate unit (512).

13. The structure according to claim 1, wherein the plurality of ventilation holes (516) are longitudinally formed in the radial direction of the base plate unit (512).

14. The structure according to claim 13, wherein a width of the ventilation holes (516) is equal to or greater than a height of the blades (517).

15. The structure according to claim 1, wherein the respective blades (517) are sloped against the inner or outer side of the stator coil (20).

16. The structure according to claim 15, wherein a slope angle of each of the blades (517) is between 60°-90° relative to the surface of the base plate unit (512).

17. The structure according to claim 15, wherein the respective blades (517) are formed all sloping in one direction.

18. The structure according to claim 1, wherein the blades (517) and the ventilation holes (516) are simultaneously formed by a press process.

Patentansprüche

1. Rotoraufbau für einen bürstenlosen Motor des Außenrotortyps, enthaltend:

   einen Stahlplattenrahmen (510), der eine scheibenförmige Basisplatteneinheit (512) mit einer Vielzahl von Belüftungsöffnungen (516); eine von dem äußeren Umfangsabschnitt der scheibenförmigen Basisplatteneinheit (512) über eine vorbestimmte Länge in axialer Richtung verlaufende hintere Jocheinheit (613, 713); und eine an einem Endabschnitt der hinteren Jocheinheit (613, 713) gebildete, die Steifigkeit in radialer Richtung verbessernde Einheit (618, 718) umfasst;
   einen oder eine Vielzahl von Permanentmagneten (540) des Ringtyps, die an dem Innenseitenabschnitt der hinteren Jocheinheit (613, 713) fest verbunden sind; und
   eine Befestigungseinheit, die eine in ein Verbindungselement (530) eingeführte und mit anderen Bauelementen verbundene Antriebswelle (400) befestigt,

   dadurch gekennzeichnet, dass die Basisplatteneinheit (512) eine Vielzahl von Einführöffnungen (511) in ihrem Mittelabschnitt hat, wobei die Vielzahl der Belüftungsöffnungen (516) am Umfangsabschnitt der Einführöffnungen (511) gebildet ist und eine Vielzahl von Blättern (517) an Seitenabschnitten der Belüftungsöffnungen (516) durch Stanzen gebildet sind,
   wobei das Verbindungselement (530), das mit dem Stahlplattenrahmen (510) verbunden ist, mit der Antriebswelle (400) in Eingriff steht, die in die Welleneinführöffnung (511a) der Vielzahl von Einführöffnungen (511) eingeführt ist, die in der Mitte der Basisplatteneinheit (512) positioniert sind, und
   wobei die Einheit zur Verbesserung der Steifigkeit in radialer Richtung (618, 718) an dem Endabschnitt der hinteren Jocheinheit (613, 713) in der Richtung radial nach innen oder nach außen verläuft und ein in Ringform ausgebildeter Tragrahmen (660, 760) an dem äußeren Abschnitt der Basisplatteneinheit (512) vorgesehen ist und zumindest teilweise den unteren und den seitlichen Abschnitt der hinteren Jocheinheit (613, 713) umgibt.

2. Aufbau von nach Anspruch 1, bei welchem eine Backe (513a) mit einer vorbestimmten Breite in radialer Richtung und eine in axialer Richtung relativ zu der Backe (513a) verlaufende Kontaktfläche an der Innenfläche der hinteren Jocheinheit (613, 713) gebildet sind.

3. Aufbau nach Anspruch 2, bei welchem die Permanentmagnete (540) an der Backe (513a) positioniert sind, mit der Kontaktoberfläche in Kontakt stehen und mit der hinteren Jocheinheit (613, 713) durch einen Klebstoff oder **dadurch**, dass ein Kleleharz (550) an ihren Endabschnitten positioniert wird, fest verbunden sind.

4. Aufbau nach Anspruch 1, bei welchem die Vielzahl der Einführöffnungen (511) im Mittelabschnitt gebildet ist und die Welleneinführöffnung (511a) einschließt, in die die Antriebswelle (400) eingeführt wird, sowie eine Vielzahl von Einführöffnungen (511b) für Befestigungselemente, in die ein Befestigungselement (520) eingeführt wird.

5. Aufbau nach Anspruch 4, bei welchem eine Verbindungsführungseinheit (514) vorspringend in axialer Richtung am äußeren Umfangsabschnitt der Einführöffnung (511b) für das Befestigungselement gebildet ist.

6. Aufbau nach Anspruch 4, bei welchem das Verbindungselement (530) enthält:

   eine ringförmige Flanscheinheit (531), die eine vorbestimmte Dicke und Fläche hat;
   eine im Mittelabschnitt der Flanscheinheit (531) axial verlaufende Buchseneinheit (532), die einen vorbestimmten Außendurchmesser und eine vorbestimmte Länge hat;
   eine gezahnte Öffnung (533), die an einem inneren Umfangsabschnitt einer in der Buchseneinheit (532) in axialer Richtung gebildeten Durchgangsöffnung (532a) gebildet ist und mit einer an der Antriebswelle (400) gebildeten Zahnwelleneinheit (401) in Eingriff ist; und
   eine Vielzahl von Kombinationseinheiten (534) zum Kombinieren des Verbindungselements (530), die an der Flanscheinheit (531) gebildet und an dem Befestigungselement (520) befestigt sind.

7. Aufbau nach Anspruch 6, bei welchem eine Führungsöffnung (535), in welche die an der Basisplatteneinheit (512) gebildete Verbindungsführungseinheit (514) eingeführt ist, mit einer vorbestimmten Tiefe an den Kombinationseinheiten (534) zum Kombinieren des Verbindungselements (530) gebildet ist.

8. Aufbau nach Anspruch 7, bei welchem ein spezieller Führungsstift an der Verbindungsführungseinheit (514) befestigt ist.

9. Aufbau nach Anspruch 6, bei welchem die Vielzahl der Kombinationseinheiten (534) zum Kombinieren des Verbindungselements (530) in einer konzentrischen Kreisform angeordnet ist.

10. Aufbau nach Anspruch 1, bei welchem eine Vielzahl

von die Steifigkeit verbessernden Rippen (515) in radialer Richtung in einem vorbestimmten Abschnitt der Basisplatteneinheit (512) gebildet sind und eine oder mehrere Belüftungsöffnungen (516) und Blätter (517) zwischen den die Steifigkeit verbessernden Rippen (515) gebildet sind.

11. Aufbau nach Anspruch 10, bei welchem eine Prägerichtung der die Steifigkeit verbessernden Rippen (515) zu einem Endabschnitt der Basisplatteneinheit (512) hin vorspringt.

12. Aufbau nach Anspruch 10, bei welchem eine Prägerichtung der die Steifigkeit verbessernden Rippen (515) zu dem anderen Endabschnitt der Basisplatteneinheit (512) hin vorspringt.

13. Aufbau nach Anspruch 1, bei welchem die Vielzahl der Belüftungsöffnungen (516) in radialer Richtung der Basisplatteneinheit (512) länglich gebildet ist.

14. Aufbau nach Anspruch 13, bei welchem eine Breite der Belüftungsöffnungen (516) gleich oder größer als eine Höhe der Blätter (517) ist.

15. Aufbau nach Anspruch 1, bei welchem die jeweiligen Blätter (517) gegen die Innenseite oder die Außenseite der Statorspule (20) geneigt sind.

16. Aufbau nach Anspruch 15, bei welchem ein Neigungswinkel jedes der Blätter (517) zwischen 60° - 90° relativ zu der Oberfläche der Basisplatteneinheit (512) ist.

17. Aufbau nach Anspruch 15, bei welchem die jeweiligen Blätter (517) alle in eine Richtung geneigt gebildet sind.

18. Aufbau nach Anspruch 1, bei welchem die Blätter (517) und die Belüftungsöffnungen (516) durch einen Pressvorgang gleichzeitig geformt werden.

Revendications

1. Structure d'un rotor pour moteur sans balais à rotor extérieur comprenant:

   un cadre de plaque d'acier (510), comprenant une unité de plaque de base en forme de disque (512) ayant une pluralité de trous de ventilation (516), une unité de culasse arrière (613, 713) s'étendant sur une longueur prédéterminée dans le sens axial depuis la partie circonférentielle externe de l'unité de plaque de base en forme de disque (512); et une unité raidisseuse (618, 718) dans la direction radiale formée à une portion d'extrémité de l'unité de culasse arrière (613, 713);

   un ou plusieurs aimants permanent du type annulaire (540) étant connectés fixement à la portion latérale interne de l'unité de culasse arrière (613, 713) ; et

   une unité de fixation fixant un arbre moteur (400) inséré dans un organe de connexion (530) et connecté aux autres composants,

   caractérisé en ce que l'unité de plaque de base (512) a une pluralité de trous d'insertion (511) dans sa portion centrale, la pluralité de trous de ventilation (516) étant formée sur la portion circonférentielle des trous d'insertion (511), et une pluralité de lamelles (517) étant formée sur des parties latérales des trous de ventilation (516) par découpage,

   dans lequel l'organe de connexion (530) connecté à l'organe de plaque d'acier (510) est engagé avec l'arbre moteur (400) qui est inséré dans un trou d'insertion (511a) de la pluralité des trous d'insertion (511) positionnés au centre de l'unité de plaque de base (512) et

   dans lequel l'unité raidisseuse dans la direction radiale (618, 718) est étendue dans la direction radiale interne ou externe sur la portion d'extrémité de l'unité de culasse arrière (613, 713), et un cadre support (660, 760) formé dans une forme angulaire est prévu sur la portion externe de l'unité de plaque de base (512) entourant au moins partiellement les portions de fond et latérales de l'unité de culasse arrière (613, 713).

2. Structure selon la revendication 1, dans laquelle une mâchoire (513a) ayant une largeur prédéterminée dans une direction radiale et une surface de contact s'étendant dans une direction axiale par rapport à la mâchoire (513a) sont formées sur la surface interne de l'unité de culasse arrière (613, 713).

3. Structure selon la revendication 2, selon laquelle les aimants permanents (540) sont positionnés sur la mâchoire (513), entrent en contact avec la surface de contact et sont connectés fixement à l'unité de culasse arrière (613, 713) par une colle ou en positionnant une résine pour adhérer (550) à leur portions d'extrémité.

4. Structure selon la revendication 1, selon laquelle la pluralité des trous d'insertion (511) sont formés sur la portion centrale et comprennent le trou d'insertion d'arbre (511a) dans lequel est inséré l'arbre moteur (400) et une pluralité de trous d'insertion d'organe de fixation (511b)
   dans lesquels est inséré un organe de fixation (520).

5. Structure selon la revendication 4, selon laquelle une unité de guide de connexion (514) est formée comme une protubérance dans le sens axial sur la portion

externe de la circonférence du trou d'insertion d'organe de fixation (511b).

6. Structure selon la revendication 4, selon laquelle l'organe de connexion (530) comprend:

   une unité de bride annulaire (531) ayant une épaisseur et une superficie prédéterminées ;
   une unité de bossage (532) s'étendant axialement sur la portion centrale de l'unité de bride (531), et ayant un diamètre externe et une longueur prédéterminées ;
   un trou dentelé (533) formé sur une portion interne de circonférence d'un trou débouchant (532a) formé sur l'unité de bossage (532) dans des directions axiales et engagé avec une unité d'arbre dentelé (401) formé sur l'arbre moteur (400); et
   une pluralité d'unités de combinaison (534) pour combiner l'organe de connexion (530) formé sur l'unité de bride (531) et attaché à l'organe de fixation (520).

7. Structure selon la revendication 6, selon laquelle un trou de guidage (535) dans lequel est insérée l'unité de guidage de connexion (514) formée sur l'unité de plaque de base (512), est ménagé avec une profondeur prédéterminée sur les unités de combinaison (534) pour combiner l'organe de connexion (530).

8. Structure selon la revendication 7, selon laquelle une broche spécifique de guidage est fixée à l'unité de guidage de connexion (514).

9. Structure selon la revendication 6, selon laquelle la pluralité d'unités de combinaison (534) pour combiner l'organe de connexion (530) est prévue pour former un cercle concentrique.

10. Structure selon la revendication 1, selon laquelle une pluralité de nervures raidisseuses (515) est formée dans la direction radiale sur une portion prédéterminée de l'unité de plaque de base (512) et un ou plusieurs trous de ventilation (516) et lamelles (517) sont formés entre les nervures raidisseuses (515).

11. Structure selon la revendication 10, dans laquelle une direction de bossage des nervures raidisseuses (515) fait saillie en direction d'une portion d'extrémité de l'unité de plaque de base (512).

12. Structure selon la revendication 10, selon laquelle une direction de bossage des nervures raidisseuses (515) fait saillie en direction de l'autre portion d'extrémité de l'unité de plaque de base (512).

13. Structure selon la revendication 1, dans laquelle la pluralité des trous de ventilations (516) sont formés longitudinalement dans la direction radiale de l'unité de plaque de base (512).

14. Structure selon la revendication 13, dans laquelle une largeur des trous de ventilation (516) est égale à ou supérieure à une largeur des lamelles (517).

15. Structure selon la revendication 1, dans laquelle les lamelles respectives (517) sont inclinées en direction de la face interne ou externe de la bobine de stator (20).

16. Structure selon la revendication 15, selon laquelle un angle d'inclinaison de chacune des lamelles (517) est compris entre 60° et 90° par rapport à la surface de plaque de base (512).

17. Structure selon la revendication 15, selon laquelle les lamelles respectives (517) ont toutes une forme inclinée dans une direction.

18. Structure selon la revendication 1, selon laquelle les lamelles (517) et les trous de ventilation (516) sont formés simultanément par un processus de pression.

FIG. 1

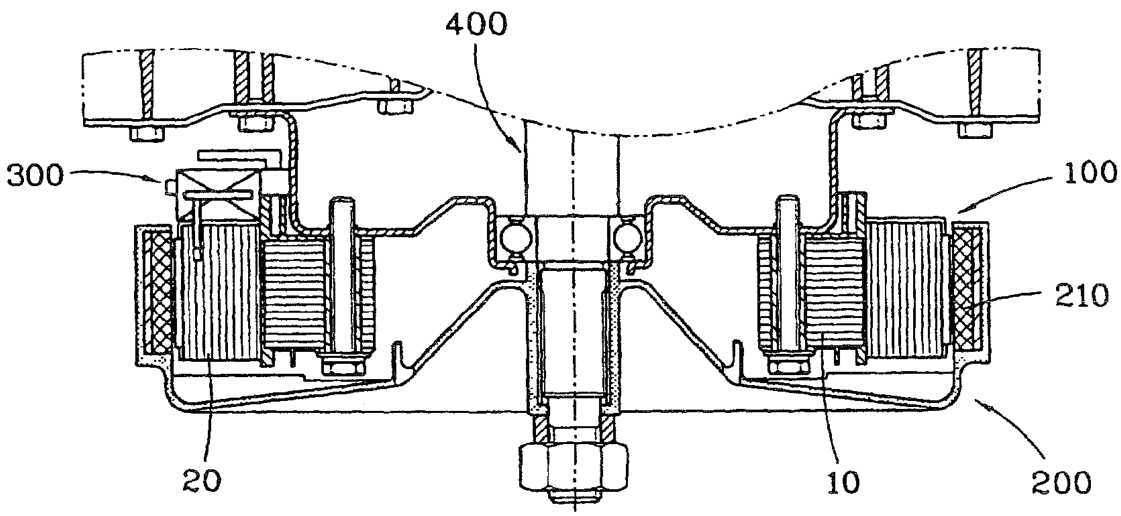
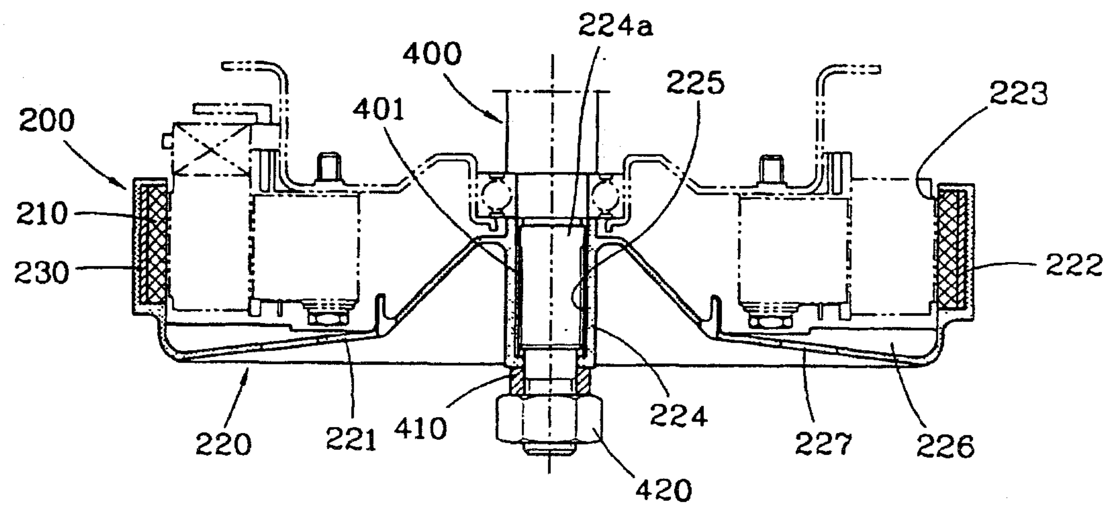


FIG. 2A


224a
400
225
223
200
401
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222
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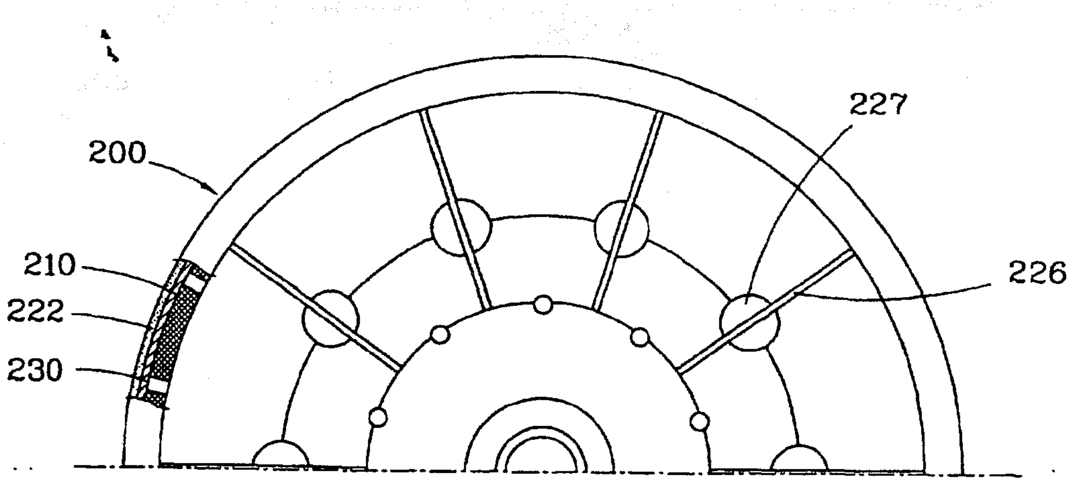
221
410
224
227
226
420

FIG. 2B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222
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FIG. 3A

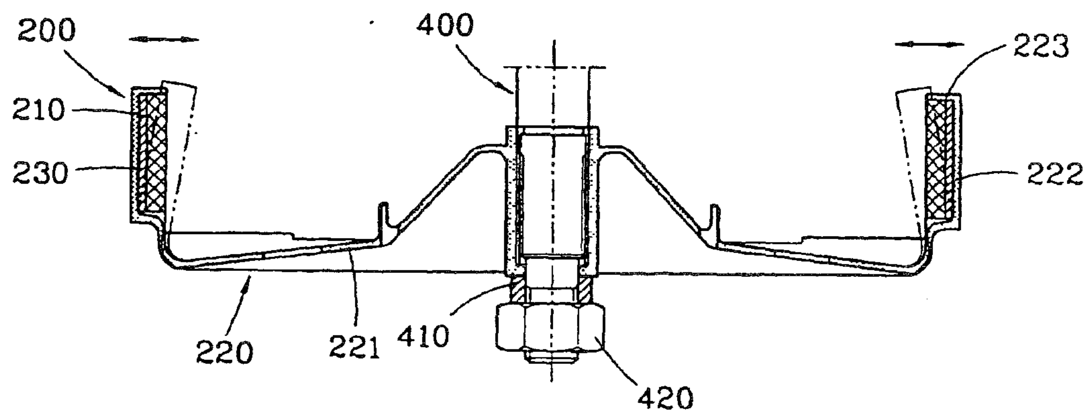
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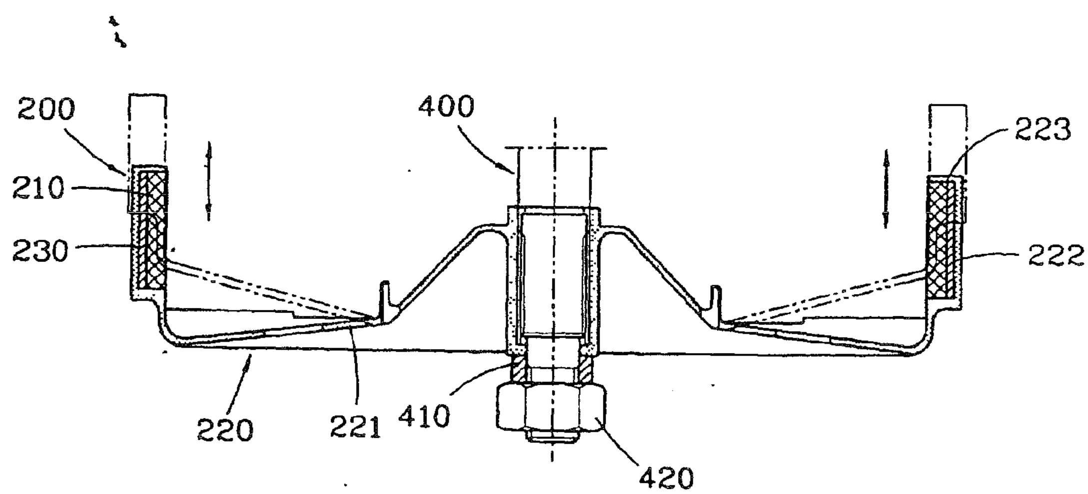
FIG. 3B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220
221
410
420

FIG. 4A

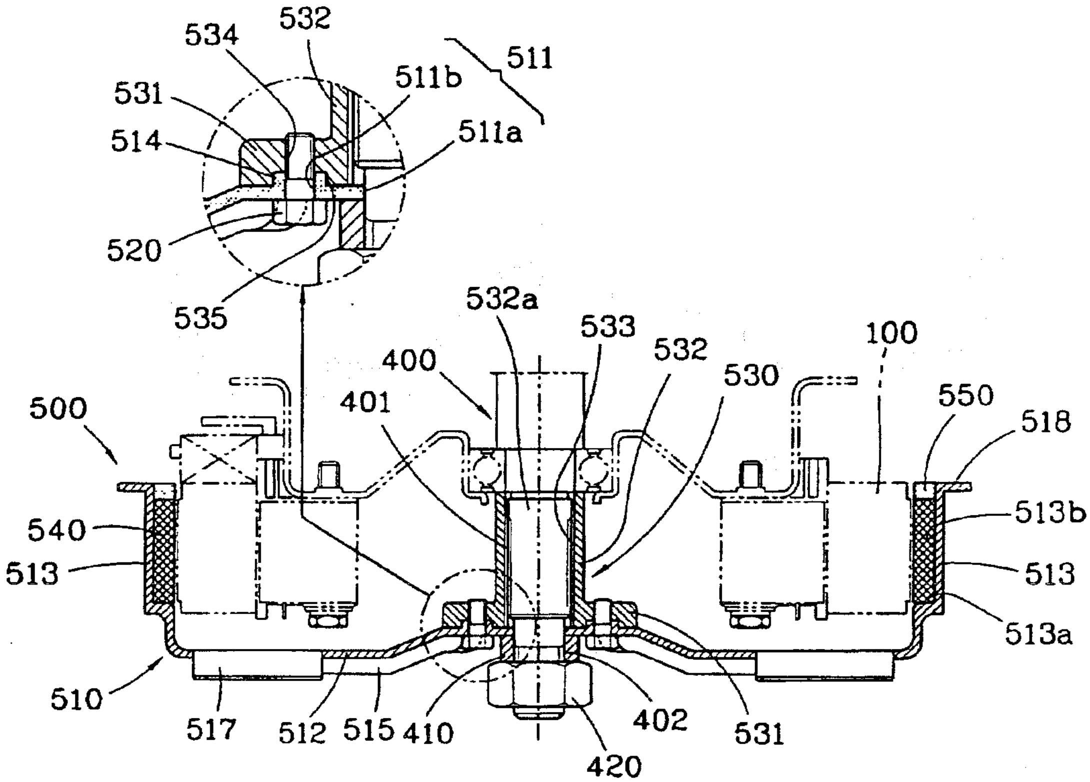

534
532
511
531
511b
514
511a
520
535
532a
533
532
100
400
530
401
500
550
518
540
513b
513
513
513a
510
517
512
515
410
402
531
420

FIG. 4B

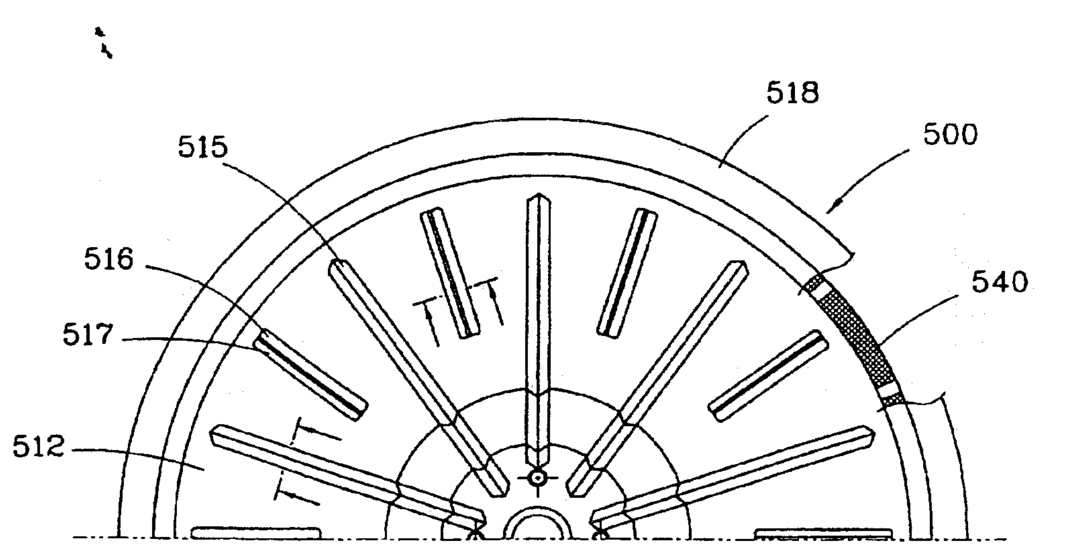

518
500
515
516
540
517
512

FIG. 4C

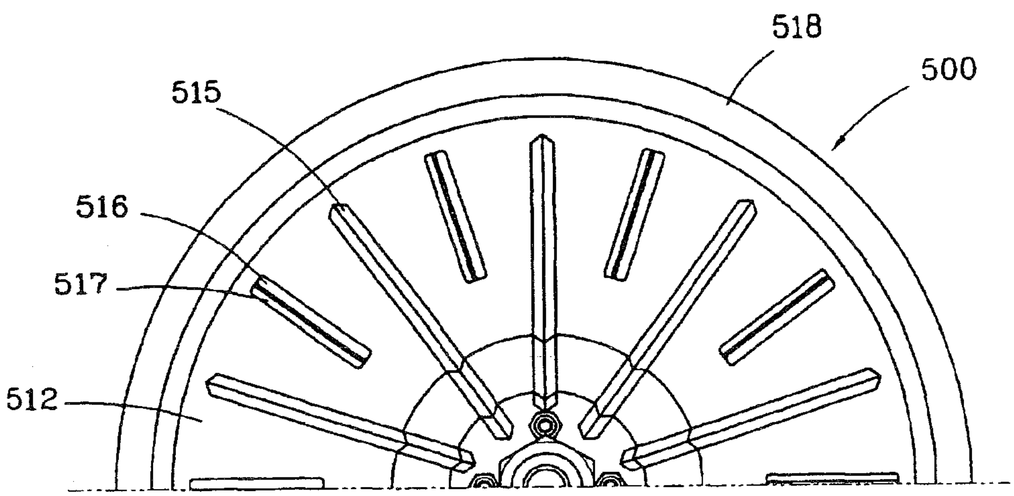


FIG. 5A

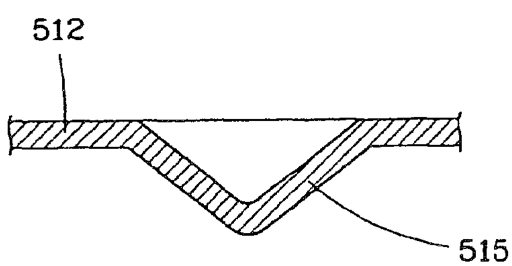


FIG. 5B

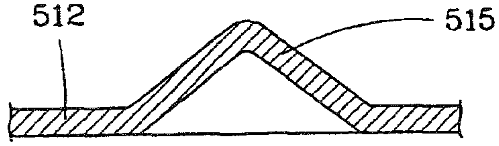


FIG. 6

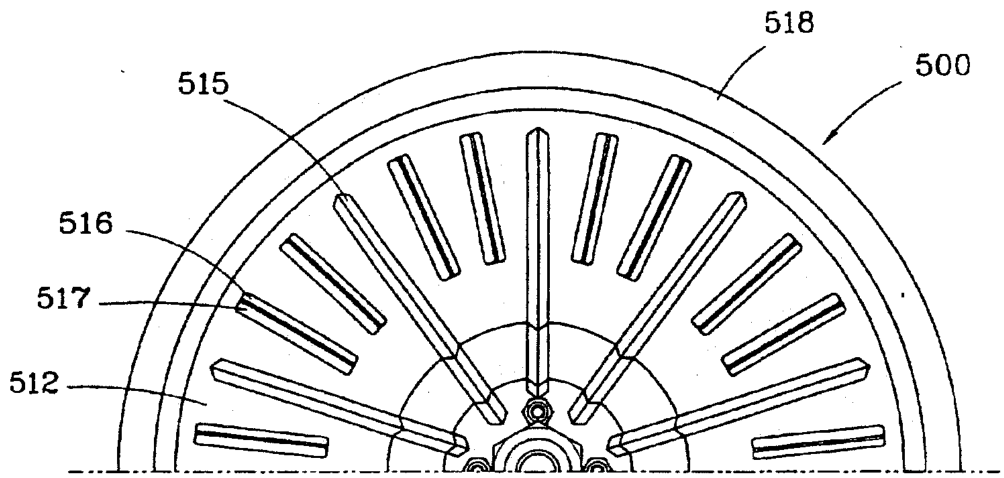


FIG. 7A

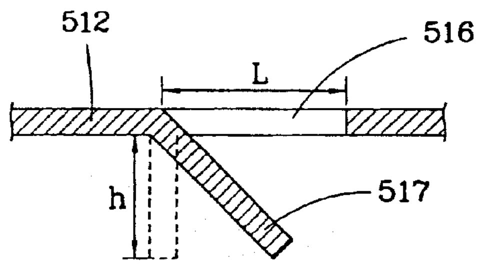


FIG. 7B

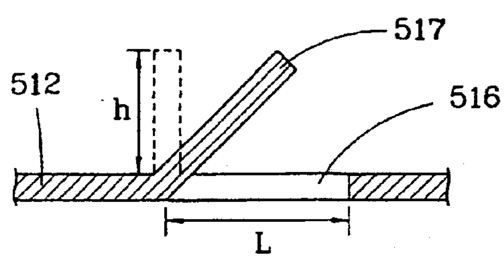


FIG. 8

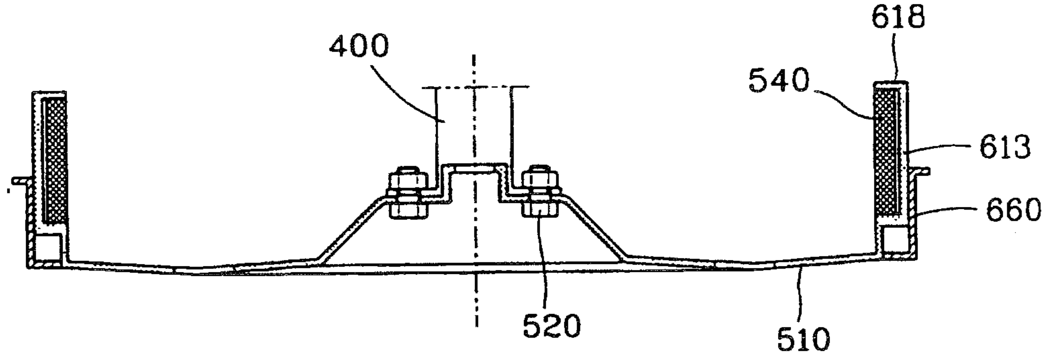


FIG. 9

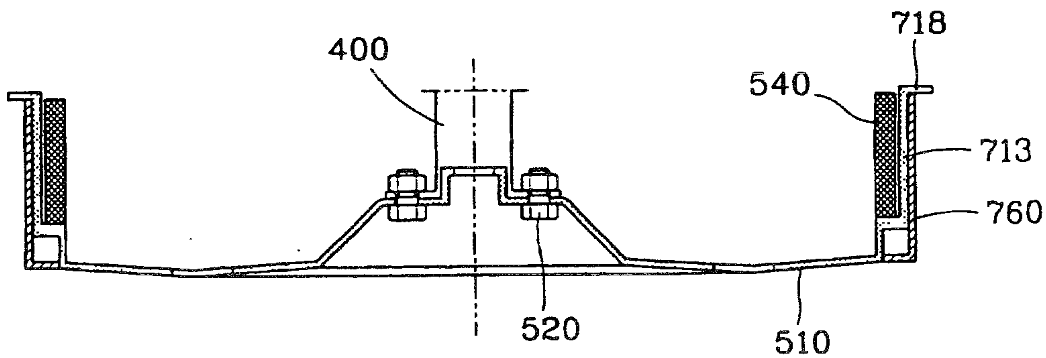


FIG. 10

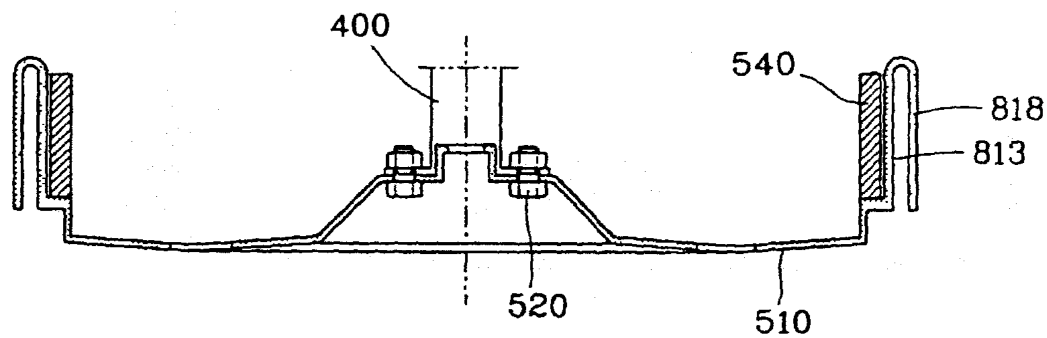
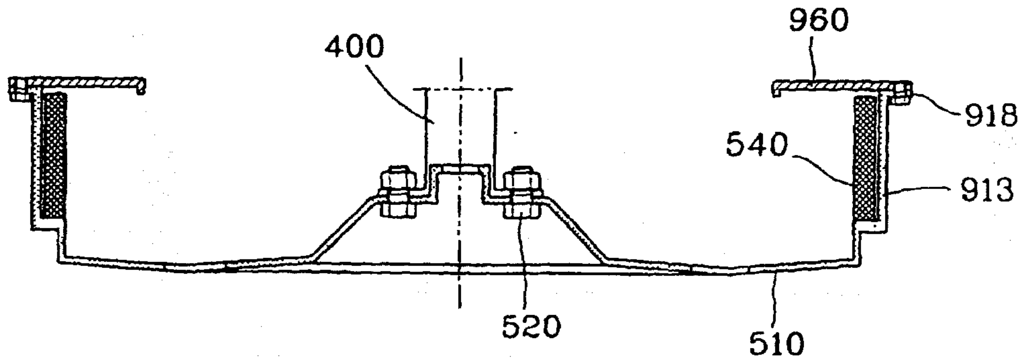


FIG. 11



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